Volume of Composite Figures

Volume of Composite Figures: Apply, Compare, and Design

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Split a solid into rectangular prisms that do not overlap, then add their volumes. Or subtract only the missing part from a full outer box. Use cubic units for volume.

Worked example

A 5 cm by 2 cm by 3 cm block is cut into 2 cm and 3 cm wide pieces. Both pieces keep the original depth and height. Show that the two pieces together have the original volume.

1. The pieces have volumes $2 \times 2 \times 3 = 12$ cm^3 and $3 \times 2 \times 3 = 18$ cm^3.
2. The sum is $12 + 18 = 30$ cm^3, the same as $5 \times 2 \times 3 = 30$ cm^3 for the original block.
Answer: Both methods give 30 cm^3.

Practice Problems

Show your thinking.

1. Each of two identical clay models joins a 4 cm by 2 cm by 5 cm prism to a 2 cm by 2 cm by 2 cm prism without overlap. You have 100 cm^3 of clay and must set aside 8 cm^3 for repairs. Can you make both models? Give the surplus or shortfall.

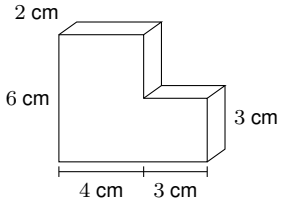
2. Each design joins two prisms side by side without overlap. Plan A uses 3 by 2 by 6 cm and 2 by 2 by 3 cm. Plan B uses 2 by 3 by 5 cm and 3 by 3 by 2 cm. The last measure is height. Which plan occupies at least 46 cm^3 and is no taller than 5 cm?

3. A stepped block has a rectangular footprint. Its left prism has a 12 cm^2 base and is 5 cm high; the right has a 6 cm^2 base and is 2 cm high. Keep the bases fixed and lower the left by 1 cm. How high must the right be to keep the same volume? What solid results?

4. A stepped display must occupy 72 cm^3. Its left part is 4 cm wide and 5 cm high. Its right part is 2 cm high. The parts share a 2 cm depth and sit side by side. Find the right width. Will the display fit a shelf with 12 cm of width available?

5. A wax block measures 7 cm by 4 cm by 5 cm. A 3 cm by 4 cm by 2 cm corner is cut away. The remaining wax is melted into 30 cm^3 molds with no loss. How many molds can be filled, and how much wax is left?

6. Each piece for shipping must be at most 45 cm^3. For this stepped solid, compare a vertical cut from the inside corner down with a horizontal cut from the corner to the left edge. Each cut goes through the depth. Which cut works, and what are its piece volumes?



Answer Key

1. No. You are short 4 cm^3.
2. Plan B only: 48 cm^3 and 5 cm tall.
3. The right must be 4 cm high. The whole solid becomes a rectangular prism.
4. Right width 8 cm; yes, the full width is exactly 12 cm.
5. 3 full molds; 26 cm^3 left.
6. The horizontal cut works: 42 cm^3 below and 24 cm^3 above.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. One model needs $4 \times 2 \times 5 + 2 \times 2 \times 2 = 48$ cm^3.
2. With the reserve, both models require $2 \times 48 + 8 = 104$ cm^3.
3. The shortfall is $104 - 100 = 4$ cm^3.

Problem 2

1. Plan A has volume $3 \times 2 \times 6 + 2 \times 2 \times 3 = 48$ cm^3 and reaches 6 cm.
2. Plan B has volume $2 \times 3 \times 5 + 3 \times 3 \times 2 = 48$ cm^3 and reaches 5 cm.
3. Both meet the 46 cm^3 minimum, but only B meets the 5 cm height limit.

Problem 3

1. Lowering the left by 1 cm removes $12 \times 1 = 12$ cm^3.
2. Raise the right by $12 \div 6 = 2$ cm to put that volume back. Its new height is $2 + 2 = 4$ cm.
3. The left height is $5 - 1 = 4$ cm too. The top is level over the rectangular footprint.

Problem 4

1. The left part occupies $4 \times 2 \times 5 = 40$ cm^3. The right must occupy $72 - 40 = 32$ cm^3.
2. Each centimeter of right width gives $2 \times 2 \times 1 = 4$ cm^3. The right width is $32 \div 4 = 8$ cm.
3. The full width is $4 + 8 = 12$ cm, which fits the stated width.

Problem 5

1. The full block has $7 \times 4 \times 5 = 140$ cm^3. The removed corner has $3 \times 4 \times 2 = 24$ cm^3.
2. There is $140 - 24 = 116$ cm^3 to use. Three molds need $3 \times 30 = 90$ cm^3; four would need $4 \times 30 = 120$ cm^3.
3. After three full molds, $116 - 90 = 26$ cm^3 remains.

Problem 6

1. The vertical cut gives $4 \times 2 \times 6 = 48$ cm^3 and $3 \times 2 \times 3 = 18$ cm^3. The left piece is too large.
2. The horizontal cut gives a lower piece of $7 \times 2 \times 3 = 42$ cm^3. The upper height is $6 - 3 = 3$ cm, giving $4 \times 2 \times 3 = 24$ cm^3.
3. Both horizontal pieces are at most 45 cm^3.

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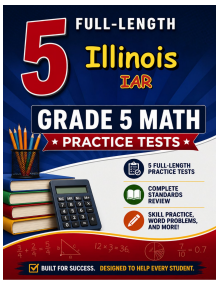

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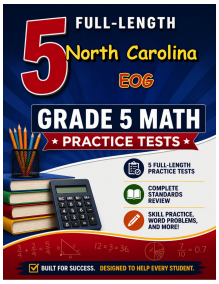

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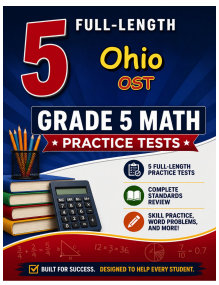

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